HAWAII AGRICULTURAL EXPERIMENT STATION, HONOLULU.

J. G. SMITH, SPECIAL AGENT IN CHARGE.

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A recent bulletin (1) published by the Philippine Bureau of Agriculture, Manila, gives many facts in regard to the cultivation of Abaca or Manila hemp, of immediate interest to farmers and planters in Hawaii.

Manila hemp was introduced into Hawaii many years ago as has been recently noted by Hon. W. M. Giffard (2) and other contributors to the daily press. There are a considerable number of mature plants in Iao Valley on Maui; and they have been so widely distributed in the past that many plants will undoubtedly be reported on all the islands of this Territory when search is made for them.

That portion of the Philippine Farmers' Bulletin, relating to Manila hemp, not being available for distribution in Hawaii, is republished herewith.

The conditions requisite to the cultivation of this crop, as outlined by Professor Gilmore, would be looked for in the windward districts, such as Hanalei, Kauai, Nahiku, Maui, and Hilo, Puna, Olaa and portions of Kau and Kona on Hawaii.

MANILA HEMP OR ABACA.

"This fiber, so well known in commerce, is produced by a species of the banana family (*Musa textilis*). *Musa* is quite a large and specialized genus, and some of the species comprise several varieties. Among the Filipinos the genus is divided into three groups —the plants which produce the edible banana of commerce (Visaya, saging); those which produce the fiber under consideration (abaca); and the wild banana (pacol), which has no recognized economic value. The plants of all these species produce a fiber of greater or less strength, and in tropical countries where the plants grow the fiber generally finds some use in the economy of the natives.

"Although the various species of the genus *Musa* flourish in nearly all tropical countries of the world, *Musa textilis*, from which the Manila hemp is obtained, seems to thrive to the best advantage only in the Philippines. Attempts have been made to introduce it into other countries where other closely related species grow, but these attempts have not been successful.

"*Musa textilis* requires a uniformly moist and warm climate for its best growth and developmenmt. While it may be found almost throughout the entire Archipelago, yet it grows to best advantage in the Provinces of Albay, Camarines Norte and Sur, Sorsogon, and in the islands of Masbate, Mindoro, Marinduque, Samar, Leyte, Cebu, Southern Negros, and parts of Mindanao. In these regions there is an abundant rainfall and a high relative humidity of the atmosphere."

In a table which accompanies this paragraph Mr. Gilmore states that the mean annual temperature in the abaca districts ranges from 78° to 80.5° F., the rainfall from 31 to 125 inches, and the number of rainy days from 110 to 218. He further says that the relative humidity of the atmosphere has an important bearing on the growth and development of this plant, there being many days of excessive humidity when there is no actual rainfall.

"In selecting a site for a plantation, four considerations are to be borne in mind, the rainfall, the humidity of the atmosphere, the soil in particular reference to exposure and drainage, and protection from excessive sun and wind. Of these an abundant rainfall and a high relative humidity of the atmosphere are most important.

"These characteristics of any situation to be devoted to *Musa textilis* insure a more vigorous development of the plant and consequently a greater production and a better quality of fiber. But it must not be supposed that the plant requires a wet soil. Moisture is what it demands and not water. The plant will not thrive in marshy land, no matter what the rainfall and protection from wind and sun may be. In its natural choosing the plant selects the well-drained mountain slopes and the sloping valleys lying between their spurs. In these situations sufficient trees grow or are left to grow to protect the fiber plants from the fullest rays of the sun and from the strong winds. In addition to this the soil is naturally well drained, is rich in humus, and in such places there are usually washings and other movements of the soil sufficient to answer for a sort of cultivation.

"The cultivation of *Musa textilis* is not a difficult matter; though judicious care and shading will bring good harvests. The plants are set in rows from 5 to 8 feet each way, and until they reach maturity it is necessary to keep the weeds in subjection. The plants reach maturity in from two and one half to three and one-half years, when they are usually left to themselves with the exception that coarse weeds are kept out. It is quite necessary that the ground be kept covered with some herbage, for the land is usually so rolling that otherwise washing would do much damage. No better scheme could be employed, either on rolling or level land, than that of sowing in the plantation some of the clovers or other leguminous crops, which would not only bind the soil to prevent washing, but would add to the soil a most useful element, nitrogen. In most situations trees are left growing in the plantations or are afterwards planted for the purpose of shading the plants to some extent from the glaring rays of the sun and to break the force of the winds which would tear the leaves to pieces and retard the development of the plant. This is especially desirable on young plantations. The trees, however, should have small leaves in order that a dark shade may not be produced, and they should have deep feeding roots in order that the fiber plants be not robbed of their plant food.

"From the nature of the structure of all banana leaves these plants are very poorly adapted to withstand the force of strong winds. In such winds the leaves are soon torn into shreds, and hence their functions as assimilators of plant food is very much diminished. Therefore the necessity of choosing situations as free as possible from strong winds.

"Unlike many of the edible bananas, *Musa textilis* produces seed-bearing fruits. These seeds may be planted for the reproduction of new plants; but, except where very extensive plantings are wanted, a better method is to plant the small suckers which spring from the root of the parent plant. After the plantation has reached its maturity and harvesting is in process, the old plants are cut near the roots and the suckers are left to grow up. After the plants reach maturity the crop is constantly renewing itself, so that harvesting can go on almost continuously. The plant is in the best condition for producing fiber about the time the flower bud reaches the top of the plant. The stalk is then cut as near the root as possible and the leaf-sheaths are stripped off. The fiber is the so-called *fibro-vascular* bundles which make up part of the structural substance of the leaf-sheath surrounding the flower stem from the ground to the expansion of the leaves. The length of the leaf-sheath surrounding the flower stem determines to some extent the length of the fiber. This leaf-sheath is thicker along the center than at the sides, and in order to facilitate the stripping of the fiber it is split longitudinally into strips two or three inches wide. The strips from the thicker portion of the sheath are then torn tangentially, inasmuch as the fiber is contained mainly in the outer part of the sheath, and the inner portion of the thick strips which are torn off consist mainly of valueless pulp.

"For stripping the fiber the method almost universally in use is to draw these prepared strips between the edge of a knife and a hard, smooth block. The apparatus can be set up at frequent intervals in the vicinity of the plants to be cut. A nipa (palm-thatched) shed is constructed, though sometimes the protection and shade of a large tree is chosen. To two uprights set in the ground a horizontal pole is attached with rattan canes. A short strong knife with a wooden handle is firmly attaced on a pivot or fulcrum upon the upper surface of the horizontal pole. The handle is attached by a rattan cane to a bamboo spring arranged in the roof of the shed or to a branch of the tree, while another rattan cane runs from the handle to a treadle on the ground, which can be worked by the foot of the operator. The spring in the roof above holds the knife upon the pole, or in some cases a block, with a uniform pressure while the strip of the leaf-sheath is being drawn between its edge and the pole or block. By placing the foot upon the treadle the pressure is released and the fiber may be redrawn or a new strip inserted.

"When it is not the desire of the operator to produce a fiber of fine texture and white color a knife with finely serrated edge may be used. By using a knife of this kind there is less waste of the fiber, but at the same time more of the undesirable pulp and consequently, fresh juice is left with the fiber. This residue of pulp and juice drying upon the fiber, gives it an undesirable color, and if too much is left on, the strength of the fiber is injured and the market value is much reduced. The whitest fiber is drawn under a knife with a smooth edge and immediately after the plant is cut. If the stalks and strips are allowed to lie in the sun for any length of time before the fiber is drawn the fiber will be colored more or less yellow. As a means of increasing the fineness and whiteness of the fiber the strips may be drawn several times when they are fresh. Of course the greater the number of times the fiber is drawn and the greater the pressure upon the knife the more is the waste, but the increased value of white fiber will compensate for a certain amount of waste.

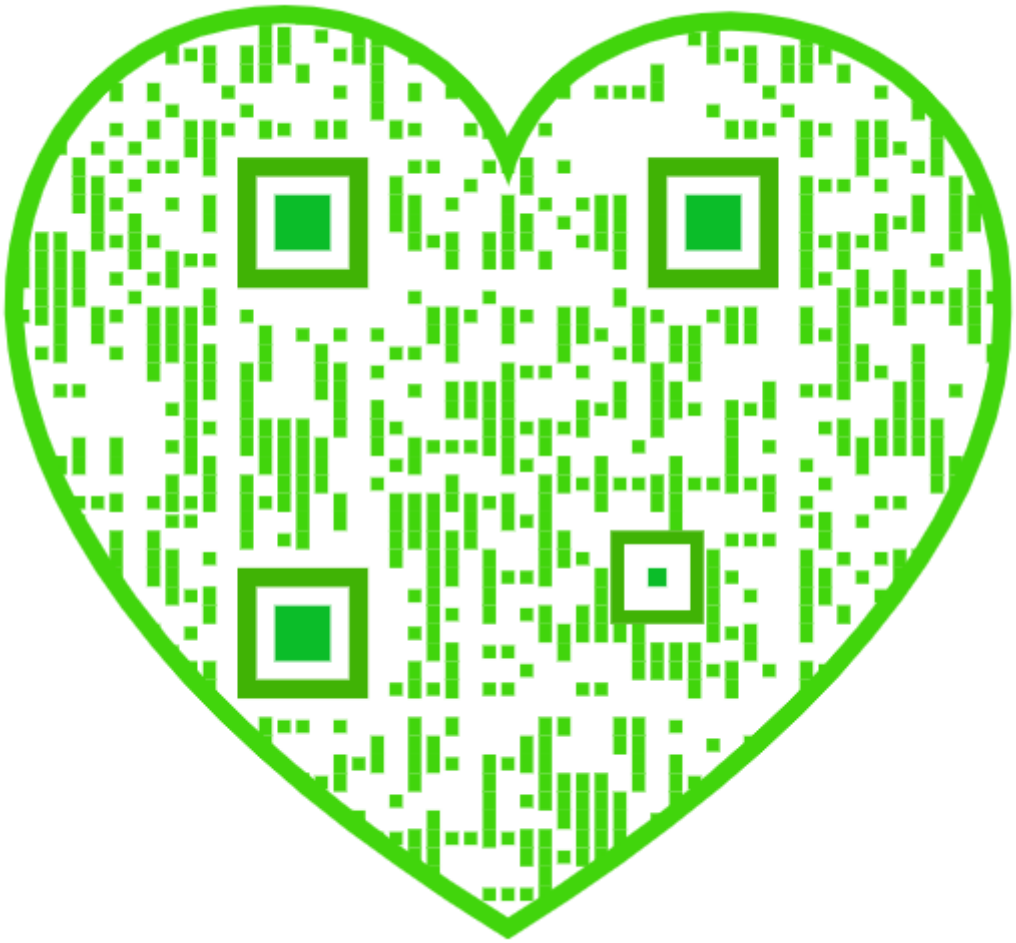
"In yield *Musa textilis* varies considerably. In Albay, Sorgoson, and Masbate, where the rainfall is heavy and the humidity of the atmosphere is high, the yield ranges from 687.5 to 967.6 pounds of dry fibre per acre each year. In other provinces where the climate is dryer the yield may not exceed 340 pounds per acre. In some localities the quality of the fiber is injured by the work of borers. Wherever these insects work the fiber is either cut entirely or it is injured in color and strength.

"Several attempts have been made to perfect machines for extracting this fiber economically, but these machines have either fallen far short of their requiremnts or have not met with favor among the natives who had occasion to use them. The most essential feature at the present time of a machine for this work is that it be light and portable. The greater part of Manila hemp is produced on the mountain or volcanic slopes or on very rough ground, and as the plant stalks are quite heavy all planters have found it most economical to transport their apparatus rather than the material. It is hoped, however, that some apparatus can be devised to avoid the great waste which renders the present method objectionable. It is variously estimated that from 20 to 30 per cent. of the fiber is wasted by this crude process of drawing, and this fiber, too, is fine and of good quality. The thought is at once suggested that this waste fiber might be used as a paper stock if it is not too much injured by the juice and pulp with which it is mixed and if it can be economically separated from them.

"For commercial purposes the fiber is classified into several groups according to color, texture, and strength. Length plays a less important part in the commercial grades. The great lightness, combined with strength, is the characteristic of this fiber which gives it its great value. The qualities usually recognized are the superior, current, second, and red. Then there are numerous gradations in each of these groups. The fiber for export is usually tied in small wisps or hanks, and these are put up in bales weighing two piculs (275 pounds.)

"In all countries to which this fiber is exported the greater part of it is used for cordage and ropes. In the United States immense quaitities are made into binder twine, and because of its lightness, strength, and comparative durability it is very serviceable for ship's ropes and cables. From old and disintegrated ropes our valuable Manila paper is made. In the Philippines the finer qualities are used in the manufacture of textile fabrics. Throughout the entire Archipelago these weavings are worn extensively by both men and women, and when the fiber is mixed with cotton a durable fabric is produced which is well adapted to the climatic conditions of the Islands. It is believed that the demand for the better qualities of these fabrics will increase in the United States and Europe. A small use is made of the fiber in upholstery, packing and brush-making.

"Enough has been said in the general statement above to show the commercial importance of this fiber and the quantities which are being consumed. It may be that, as the wood pulp now being used so extensively for the cheaper grades of paper becomes more scarce, certain qualities of the Manila hemp may take its place."

(1) Farmers' Bul. No. 4. John W. Gilmore, Preliminary Report on the Commercial Fibers of the Philippines; Manila, P. I., 1902.

(2) Pacific Commercial Advertiser, May 17, 1903.